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THE GENUS *ALVORDIA* (COMPOSITAE)
OF A BAJA CALIFORNIA, MEXICO

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INTRODUCTION

The genus *Alvordia* Brandegee, endemic to Baja California, Mexico, has been interpreted as consisting of two taxa described by T. S. Brandegee before the turn of the century and one described by S. F. Blake in 1917. It is herein augmented by a fourth taxon found to occur on some of the islands of the Gulf of California. Evaluation of this newly recognized taxon brought to light a nomenclatural inadvertence involving the two taxa of the Cape Region, which, unfortunately, necessitates the changes which follow.

The species upon which *Alvordia* was based, *A. glomerata* Brandegee (1889), occurs in the south-central part of the peninsula of Baja California. The other two previously described taxa (*A. fruticosa* Brandegee and *A. angusta* Blake) are confined to the tip of the peninsula, the "Cape Region."

Blake (1917) found that Brandegee's concept of *A. fruticosa* actually encompassed two taxa, an ovate-leaved shrub and a lanceolate- to linear-lanceolate-leaved one. Because Brandegee had not cited a type when describing *A. fruticosa*, Blake designated as lectotype for this species, an ovate-leaved specimen seen by Brandegee (*Anthony 339*, San José del Cabo, in 1890) and then described the linear-lanceolate-leaved taxon as *A. angusta*. Unfortunately, the exigencies of war must have prevented Blake from consulting the Brandegee collections at the University of California. Had he done so, he would

have found that Brandegee *had* designated a type specimen for *A. fruticosa* and that, contrary to Blake's assumption, it represented the linear-lanceolate-leaved taxon, not the ovate-leaved one. Therefore Blake's appropriately descriptive name, *A. angusta*, must be referred to synonymy under *A. fruticosa*, and another name must be provided for the ovate-leaved taxon. This is done in the following treatment, wherein it is described as *A. Brandegeei*.

TAXONOMIC TREATMENT

Alvordia T. S. BRANDEGEE, 1889, Proc. Calif. Acad. Sci., ser. 2, vol. 2, p. 174.

Frutescent, many-stemmed, up to 2.5 m. tall. Leaves entire or some inconspicuously irregularly toothed, densely to sparsely strigillose, opposite below, the reduced upper ones alternate. Inflorescence of aggregated terminal glomerules, the subtending bracts often simulating phyllaries, the glomerules bearing (1-) 2 to 5 involucre; phyllaries (3-) 4 to 5 (6), graduate, slightly to strongly navicular; receptacular bracts subtending all flowers, those subtending disk flowers enfolding the achenes; ray flowers, when present, 1 to 3, neutral, the limb yellow, the pappus of 3 to 4 inconspicuous awns; disk flowers fertile, 1 to 3 (-4), the corolla yellow; anthers loosely joined, 2-2.8 mm. long, inconspicuously auriculate at base, the sterile apical appendage 0.6-1.0 mm. long and bearing sessile glands on the cupped abaxial surface; style slender with linear stigma lobes; achenes slightly flattened or obscurely quadrangular, narrowly obconic, the pappus of 15 to 20 unequal, lanceolate, hispid awns, 2 or 3 of them longer than the others.

KEY TO THE SPECIES AND VARIETIES OF *Alvordia*

- Phyllaries strigillose abaxially, ciliate-margined, at least the outer brownish- or greenish-yellow, with the corky-thickened navicular keel strongly arcuate; ray flowers present, usually conspicuous; disk flowers 3 (occasionally 1 or 4) to a head; pappus ¹ equalling or longer than the achenes. 1. *A. glomerata*
- Leaves lanceolate to ovate-lanceolate, acute, 1.6 to 3.3 times as long as wide; achenes 3.5-4 mm. long, equalling the pappus in length 1a. *A. glomerata*
var. *glomerata*
- Leaves oval to ovate or obovate, obtuse (except for San Marcos Island specimens which have both acute and obtuse leaves on a plant), 1.4 to 2.4 times as long as wide; achenes 2.5-2.8 mm. long, shorter than the pappus 1b. *A. glomerata*
var. *insularis*

1. Measurements based on longest pappus awns.

Phyllaries glabrous abaxially, finely ciliolate-margined, straw-colored, the navicular keel straight or slightly curved; ray flowers lacking (except for occasional inconspicuous ones in *A. Brandegeei*); pappus shorter than (or sometimes equalling) the achenes.

Leaves lanceolate to linear-lanceolate, acute, 3.4 to 6.4 times as long as wide; inflorescence 3-4 cm. in diameter; disk flowers 1 (occasionally 2) to a head. 2. *A. fruticosa*

Leaves ovate, acute, 1.5 to 2.2 times as long as wide; inflorescence 1.5-2.5 cm. in diameter; disk flowers 2 (occasionally 1 or 3) to a head. 3. *A. Brandegeei*

1. *Alvordia glomerata* BRANDEGEE, 1889, Proc. Calif. Acad. Sci., ser. 2, vol. 2, p. 174.

Leaves ovate to ovate-lanceolate or lanceolate; inflorescence 1.5-3 cm. in diameter; involucre enclosing (2-) 3 (-4) disk flowers and 1 to 3 sterile ray flowers; phyllaries greenish- or brownish-yellow, strigillose abaxially, the margins ciliate, the outer 2 phyllaries navicular with the strongly arcuate keel broadly corky-thickened; receptacular bracts subtending all flowers, those of the disk flowers strongly enfolding the achenes; an aborted flower and 2 to 3 hispid bristles borne at the center of the receptacle.

1a. *Alvordia glomerata* BRANDEGEE var. *glomerata*.

Leaves lanceolate to ovate-lanceolate, acute (21-) 30-70 mm. long, 10-25 (-38) mm. wide, 1.6 to 3.3 (mean 2.59) times as long as wide; the often sessile glomerules bearing 5 to 7 involucre 6-9 mm. long and 2.6-4.6 mm. wide with a mean length to width ratio of 1.87; phyllaries and receptacular bracts 7-10 (-12), the outer phyllaries conspicuously strigose abaxially, the margins irregularly ciliate; limb of the ray flowers 5-6 mm. long, the sterile achenes 4 mm. long, the pappus awns 3 or 4, 0.4-1.0 mm. long; disk corollas 6-7 mm. long, the lobes 1.0-1.8 mm. long, the anthers 2.8 mm. long with sterile tips 0.8 mm. long, the pollen (including spines) 28.4-48.8 (mean 40.17) microns in diameter; achenes (3-) 3.5-4 mm. long, the pappus 3.5-4 mm. long; receptacular bristles 2 to 3, 8 mm. long; chromosome number, $n=60$ (Carter 4458, 4483).

This species, upon which the genus is based, is the most widespread of the taxa, extending from Latitude 24° 35' N. (where it was collected on Isla Partida, the only "non-peninsular" locality) northward to Latitude 28° N. (Calmallí). In the Sierra de la Giganta it occurs at elevations from 600-1050 m. and is often abundant on north-facing slopes. Its distribution is undoubtedly more continuous than would appear from reference to the distribution map (figure 1). Almost no field work has been carried on in the mountainous areas between the currently known localities for *A. glomerata*. One would like to know,

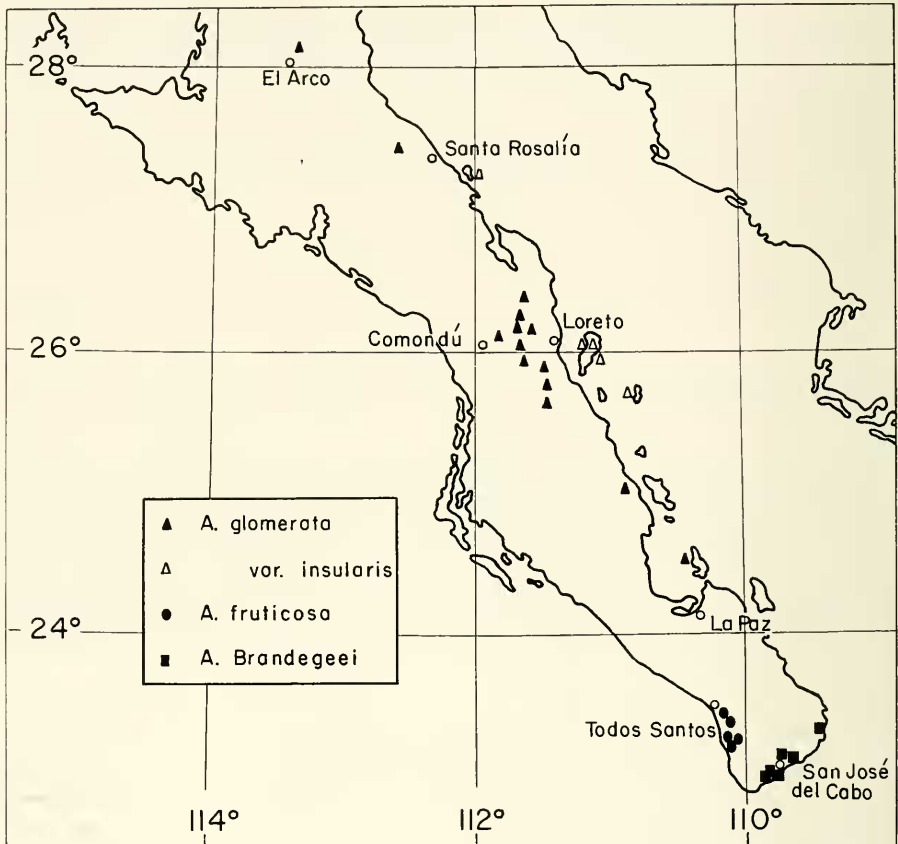


FIGURE 1. Distribution of *Alvardia* in Baja California.

however, if there is a gradual descent in altitudinal range of the plants from north to south in the Sierra Giganta. The Isla Partida and Misión Dolores collections, made at much lower altitudes than those in the northern Sierra Giganta, display characters that show close relationship to *A. Brandegeei* which occurs on coastal bluffs of the Cape Region.

TYPE. Baja California, Mexico: Comondú, 16 February 1889, *Brandegeei* (UC, no. 84277; duplicates US, GH).

OTHER COLLECTIONS. Arroyo Calmallí, January-March, 1898, *Purpus 59* (UC, US²); Purgatorio Grade, 7 March 1935, *Wiggins 7934* (UC, US, DS); Sierra

2. The abbreviations for herbaria are those cited by Lanjouw and Stafleu, 1959.

de la Giganta: Cerro de Naucajoa, 25 November 1962, *Carter* 4483, 4493³, Arroyo Hondo, north slope of Cerro Giganta, 14 December 1938, *Gentry* 4136 (UC, GH), Cañon de las Palmas, west side of Cerro Giganta, 22 April 1955, *Carter & Ferris* 3432 (UC, US, SD), Los Encinos, 28 March 1960, *Carter & Ferris* 4032, Upper "aguaje", Arroyo del Carrizo near San Javier, 15 March 1960, *Carter & Ferris* 3815, headwaters of Cañon Gabilán, 18 November 1962, *Carter* 4458, 4459, 4467, Cañon de Tiojo, La Victoria, 22 March 1960, *Carter & Ferris* 3943, Pílon de las Parras, 14 March 1961, *Carter & Sharsmith* 4032, La Esperanza, 20 April 1962, *Carter* 4405, peak south of Portezuela de Peloteado, 10 October 1963, *Carter & Medellin-Leal* 4676, Misión Dolores, 4 December 1959, *Wiggins, Carter & Ernst* 252 (DS); Isla Partida, 7 December 1959, *Wiggins, Carter & Ernst* 426 (DS).

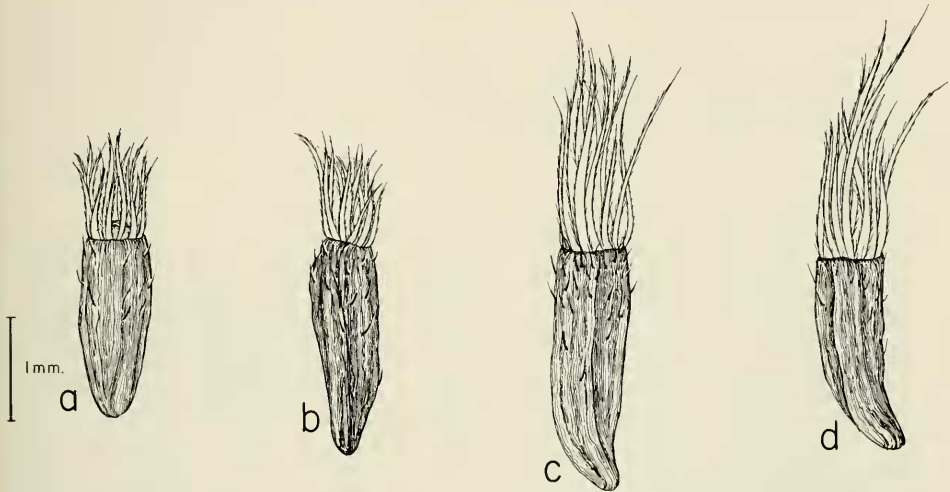


FIGURE 2. Achenes of *Alvardia*: a, *A. fruticosa* (Carter & Chisaki 3610); b, *A. Brandegeei* (Carter, Alexander & Kellogg 2273); c, *A. glomerata* (Carter & Ferris 3815); d, *A. glomerata* var. *insularis* (Carter & Ferris 3744).

1b. *Alvardia glomerata* var. *insularis*, var. nov.

A var. *glomerata* foliis ovatis obtusis longitudine 4 cm. haud excedentibus, involucri bracteis minus strigillosis valdius ciliatus ac acheniis minoribus (2.5-2.8 mm. longis) quam pappo (eo 2.8-4 mm. longo) brevioribus discedit.

3. All *Carter & Carter et al.* collections herein undesignated as to institution will be widely distributed.

Leaves oval to ovate (or obovate), obtuse or sometimes cuspidate (except on specimens from San Marcos Island which have most of the leaves acute), 14-37 (52) mm. long, 8-19 (30) mm. wide, 1.4 to 2.4 (mean 1.94) times as long as wide; involucre 5-7 mm. long, 3-4 mm. wide with a mean length to width ratio of 1.91; phyllaries and receptacular bracts 8 to 10, the outer phyllaries only slightly strigillose abaxially, strongly ciliate-margined; limb of the ray flowers 4-5 mm. long, the sterile achenes 3 mm. long, the pappus awns 1 to 4, 0.4-2 mm. long; disk corolla 6 mm. long, the lobes 0.8 mm. long; anthers 2.4 mm. long with sterile tips 0.4-0.8 mm. long; pollen (including spines), 34.6-42 (mean 38.5) microns in diameter; achenes 2.5-2.8 mm. long, the pappus 2.8-4 mm. long; receptacular bristles 2 to 3, 5-6 mm. long.

The variety *A. g. insularis* has been collected on islands on the peninsular side of the Gulf of California from latitudes 25° 39' N. to 27° 15' N.

TYPE. Baja California, Mexico: broad arroyo inland from Puerto Balandra, Isla Carmen, 11 March 1960, *Carter & Ferris 3744* (UC no. 1,245,032).

OTHER COLLECTIONS. San Marcos Island, 29 March 1962, *Moran 9000* (SD, UC); Carmen Island: 1-7 November, 1890, *Palmer 827* (GH, US, UC), 4 April 1962, *Moran 9142* (SD, UC); Catalina Island, 9 April 1962, *Moran 9350* (SD, UC).

2. *Alvordia fruticosa* BRANDEGEE, 1899, *Erythea*, vol. 7, p. 5.

Alvordia angusta Blake, 1917, *Contrib. Gray Herb.*, vol. 52, p. 42. *A. fruticosa* var. *angusta* Wiggins, 1950, *Contrib. Dudley Herb.*, vol. 4, p. 26.

Leaves lanceolate to linear-lanceolate, acute, (30) 40-115 mm. long, 6-32 mm. wide, 3.4 to 6.4 (mean 4.27) times as long as wide; inflorescence 3-4 cm. in diameter (often spherical in outline in pressed material) the numerous 1- (2) flowered heads in short-peduncled glomerules; involucre (4) 5.2-7 mm. long, 1.2-2.2 mm. wide; with a mean length to width ratio of 3.45; phyllaries and receptacular bracts (3-) 4-6, straw-yellow, glabrous except for the ciliolate margins, the outer two navicular with a straight or slightly arcuate narrow keel; ray flowers lacking; receptacular bract slightly enfolding the disk achene; disk corolla 5-6 mm. long, the lobes 1.2-2 mm. long; anthers 2.4-2.6 mm. long with sterile tips 0.8-1 mm. long; achenes 2.5-3 mm. long, the pappus awns 1-2.5 mm. long; sterile bristles in center of receptacle lacking. Pollen size, 37.8-50.4 (mean 42.9) microns (including spines). Chromosome count, $n=30$ (*Carter 4445*).

Collections to date indicate that *A. fruticosa* is confined to the lower western slopes of the Cape Region mountains and coastal mesas in the vicinity of Todos Santos and a short distance southward. The 1902 Brandegee collection labeled simply "Cape Region" may be assumed to be from this area inasmuch as the Brandegee itinerary (*Moran, 1952*) shows him to have been in the vicinity of Todos Santos in November of that year.

TYPE. Baja California, Mexico: San Jacinto, 23 October 1893, *Brandegee* (UC no. 84275).

OTHER COLLECTIONS. Cape Region, November 1902, *Brandegee* (US); Todos Santos, 29 January 1890, *Brandegee* 311 (UC, US⁴, GH⁴), type of *A. angusta* Blake), 14 February 1928, *Marcus Jones* 24105 (SD); southern edge of Todos Santos, 8 November 1962, *Carter* 4444 & 4445, 11 miles south of Todos Santos, 25 March 1935, *Whitehead* 872 (DS); foothills west side of Cape Region mountains about 3.2 km. northwest of Rancho San Jacinto, 12 November 1955, *Carter & Chisaki* 3610 (UC, DS, US, SD); 16 miles south of Todos Santos, 24 March 1935, *Shreve* 7225 (US, DS, GH).

3. *Alvordia Brandegeei*, sp. nov.

(Figure 3.)

Planta perennis basi suffrutescens foliis ovatis acutis vel aliquando obtusis longitudine 1.5-2.2 (2.7)-plo quam latitudine, involucri flosulos duos (interdum unum vel tres) ac aliquando florem unicum radialem depauperatum cingentibus, phyllaribus 5-7 (9) stramineis marginibus ciliolatis exceptis glabris, eis daubus extimis navicularibus utraque carina crassiuscula leviter arcuata instructa, flosculis 5 mm. longis, polline diametro 29.9-39.4 microns, achenis 1-2.4 mm. longis, chromosomi numero = 15.

Leaves ovate to broadly lanceolate-acute (occasionally obtuse) 14-47 mm. long, 8-22 mm. wide, 1.5 to 2.2 (mean 2.27) times as long as wide; inflorescence 1.5-2.5 cm. in diameter (not spherical in outline in pressed material), the short-peduncled glomerules bearing 2 to 5 involucre 5.4-6.2 mm. long, 2-3 mm. wide with a mean length to width ratio of 2.24; involucre usually enclosing 2, or sometimes 1 or 3, disk flowers and occasionally 1 poorly-developed ray flower; phyllaries and receptacular bracts 5-7 (9), straw-yellow, glabrous except for the ciliolate margins, the outer 2 slightly navicular with a thickened narrow keel; a single inconspicuous ray flower occasionally present; receptacular bracts slightly enfolding disk achenes; disk corolla 5 mm. long, the lobes (1.4-) 2 mm. long, the anthers 2-2.8 mm. long with sterile tips 0.4-0.6 (0.8) mm. long; pollen (including spines) 29.9-39.4 (mean 33.7) microns in diameter; achenes 2.4-3 mm. long, the pappus 1-2.4 mm. long; sterile bristles in center of receptacle lacking; chromosome number, $n=15$ (*Carter* 4442).

This ovate-leaved taxon appears to be confined to the tip of the Cape Region, extending from near Cabo San Lucas east to San José del Cabo and north along the Gulf coast to Punta Frailes. This is the taxon which Blake misinterpreted as representing *Brandegee's A. fruticosa*.

4. The date of 29 January 1889 given on the US and GH specimens is in error. (Neither of these labels is in *Brandegee's* handwriting.) *Brandegee* was at the coastal Magdalena Plain localities of Boca de Santo Domingo and Boca de las Animas on that date (Moran, 1952). His first trip to the Cape Region was in January and February of 1890.



FIGURE 3. Type of *Alfordia Brandegeei* Carter.

TYPE. Baja California, Mexico: San José del Cabo, Baja California, Mexico, 9 September 1890, *T. S. Brandegee 311a* (UC, no. 84274).

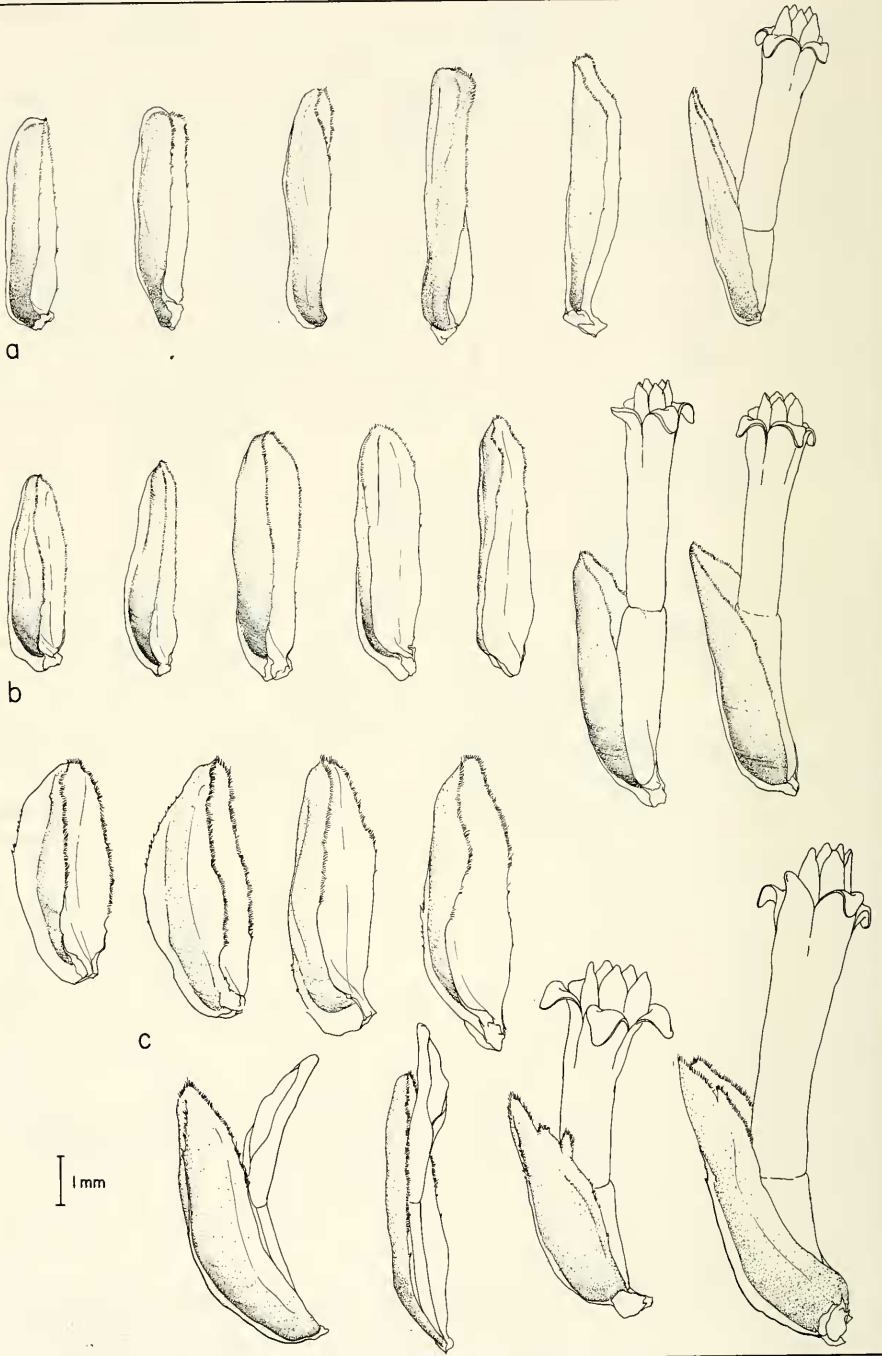
OTHER COLLECTIONS. Cape Region: November 1902, *Brandegee* (UC, US); Punta Frailes, 16 February 1940, *Dawson 1114* (US); San José del Cabo: 29 September 1893, *Brandegee* (US), March-June (April 23) 1897, *Anthony 339* (designated by Blake as lectotype of *A. fruticosa* Brandegee, UC, DS, US, GH), March 1890, *Grabendorfer* (UC); January-March 1901, *Purpus 346* (UC), *Purpus 499* (UC, US), 29 October 1941, *Gander 9730* (CAS, SD), 17 February 1940, *Dawson 1172* (US); 4.5 km. westerly from La Palmilla, 18 January 1959, *Moran 7072* (DS, SD); 4 (5) miles east of Cabo San Lucas, 26 March 1935, *Shreve 7263* (UC, DS); 9.6 km. east of Cabo San Lucas, 4 November 1962, *Carter 4442*, 8 miles east of village of Cabo San Lucas, 1 January 1959, *Wiggins 14651* (UC, DS); 11.5 km. east of Cabo San Lucas, 18 December 1947, *Carter, Alexander & Kellogg 2273* (UC, US, DS).

DISCUSSION

The members of the genus *Alvordia* (placed in the Engler and Prantl system between the two large helianthoid genera *Viguiera* and *Helianthus*) exhibit a wide range of the characters, considered, by those concerned with theories of evolution in the Compositae, as phylogenetically significant (Cronquist, 1955). The plants range from those bearing flower-head clusters having no ray flowers through those with inconspicuous sterile rays to those with obvious sterile ray flowers, and from those with involucre bearing a single disk (and no ray) flower to those bearing three to four disk flowers plus the sterile rays. The simpler arrangements are found in the Cape Region plants. The phyllaries in the Cape Region taxa, especially in *A. fruticosa*, tend toward a paired arrangement, while in the other taxa a spiral arrangement is more evident. The earlier workers considered that there were no receptacular bracts present in the Cape Region plants, but that these structures occurred in the northern *A. glomerata*. In describing *A. fruticosa*, Brandegee (1899) stated, "If this species from the Cape had been the one first collected, its relationship would have been somewhat doubtful on account of the absence of receptacular bracts."

In order to resolve the question of absence or presence of receptacular bracts and establish criteria for differentiation between phyllaries and receptacular bracts in *Alvordia*, dissections were made of the flower-heads of all four taxa. Measurements of the length of the phyllaries and bracts served to bring to light sequential relationships which aid in differentiating these structures as well as in separating the taxa.

The phyllaries are graduated, both in length and in degree of navicularness (figure 4, a, b, c). In the northern *A. glomerata* and its variety, the increase in length between the phyllaries is in gradual steps (figures 4, c; 5).



In the two Cape Region taxa, *A. fruticosa* and *A. Brandegeei*, however, there is a noticeable length gap between the first two phyllaries and the remainder of these structures (figure 5). In addition the phyllaries are straw-color and not strongly navicular in outline in the Cape Region plants while in *A. glomerata* and its variety they are brownish- or greenish-yellow and more strongly navicular. It is undoubtedly these points of similarity between *A. fruticosa* and *A. Brandegeei* that have caused previous investigators to consider *A. Brandegeei* to be more closely related to *A. fruticosa* than to the northern *A. glomerata*. On the other hand, even though the outer two phyllaries of *A. Brandegeei* are much shorter than those succeeding, they are tending towards the strongly graduated sequence found in *A. glomerata*, while those of *A. fruticosa* are subequal (figure 5).

As for the distinction between phyllaries and receptacular bracts, it was found that in all taxa the bracts subtending the flowers are shorter (occasionally sub-equal in *A. fruticosa* and *A. Brandegeei*) than the ultimate bract of those not subtending a flower (figure 5). Moreover, the bracts subtending the flowers are more membranous than the preceding structures and are not navicular nor are they saccate at the apex, but instead taper to a point which tends to be erose (figure 4, a, b, c). Although the transition from the phyllaries to the bracts subtending the flowers is gradual, the relations of position and length, in addition to slight differences in morphology, serve to justify designation of all those structures subtending flowers (whether they be sterile ray flowers or fertile disk flowers) as receptacular bracts and to designate all others as phyllaries. Therefore, all taxa in *Alvordia* may be considered to have flower-heads bearing at least one receptacular bract.

How many of the phyllaries may be considered "navicular" is subject to interpretation. The term as defined by Lindley (1848) aptly describes the first two or three strongly arcuate and keeled phyllaries of *A. glomerata*. In *A. fruticosa*, however, the keel of the first two phyllaries is straight (or only slightly arcuate) and in *A. Brandegeei* it is slightly arcuate. In all of the taxa (figure 4, a, b, c) as one examines the head progressively inward, the phyllaries are seen to become gradually less prominently keeled and less strongly arcuate until they resemble a flat-bottomed boat with saccate apices. These inner phyllaries might be described as shallowly navicular.

Heretofore, the two Cape Region taxa have been considered more closely related to each other than to the northern *A. glomerata*. The present investigation indicates that *A. fruticosa* of the Cape Region is the most distinct taxon in the genus and that the other Cape Region taxon, *A. Brandegeei*, is more closely related to *A. glomerata* than had been realized. As to the pres-

FIGURE 4. Components of flower heads in *Alvordia* showing the transition from phyllaries to receptacular bracts: series a, *A. fruticosa* (Carter 4444, 4445); series b, *A. Brandegeei* (Grabendorfer in 1890); series c, *A. glomerata* (Carter 4483).

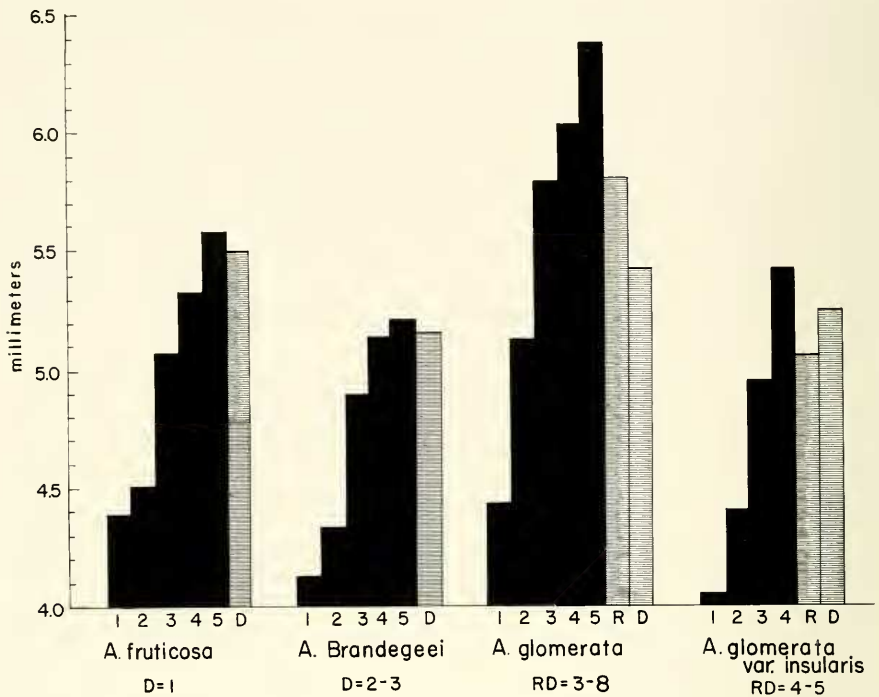


FIGURE 5. Histograms representing the relative lengths of phyllaries and receptacular bracts in *Alfordia*. Columns 1 to 5 represent the successive phyllaries; column R represents the bracts subtending the ray flowers, and column D represents the bracts subtending the disk flowers. (The histograms represent only that portion of the structures in excess of 4 mm. in length. The exceptional number of ray or disk flowers is not included.) See discussion in text.

ence or absence of sterile ray flowers, for instance, in *A. fruticosa* there are none; in *A. Brandegeei* (previously considered to have none), there is an occasional inconspicuous sterile ray flower; in *A. glomerata*, rays are always present and conspicuous in plants of the middle and northern part of its known range, but in the two southernmost collections (at Isla Partida and Misión Dolores, rays are inconspicuous, few or sometimes lacking. In other characters, too, the southernmost collections of *A. glomerata* approach those of *A. Brandegeei*, e.g., the relative length of the pappus and the achene (figure 2) and the ratio of leaf-length to width. Although there is a wide geographic gap between the northernmost known locality for *A. Brandegeei* (figure 1) and the southernmost one of *A. glomerata*, the southernmost *A. glomerata* plants are clearly transitional between the more northern members of that taxon and *A. Brandegeei*. (Graphic representation of certain characters in the four taxa is given figures 6 and 7.)

Leaves vary tremendously in size in this group of plants. Those of *A. glomerata* may be anywhere from 30 to 70 mm. in length and those of *A. fruticosa* from 30 to 115 mm. Conversion of the length and width measurements to length/width ratio, demonstrates that the leaves of each taxon do fall within

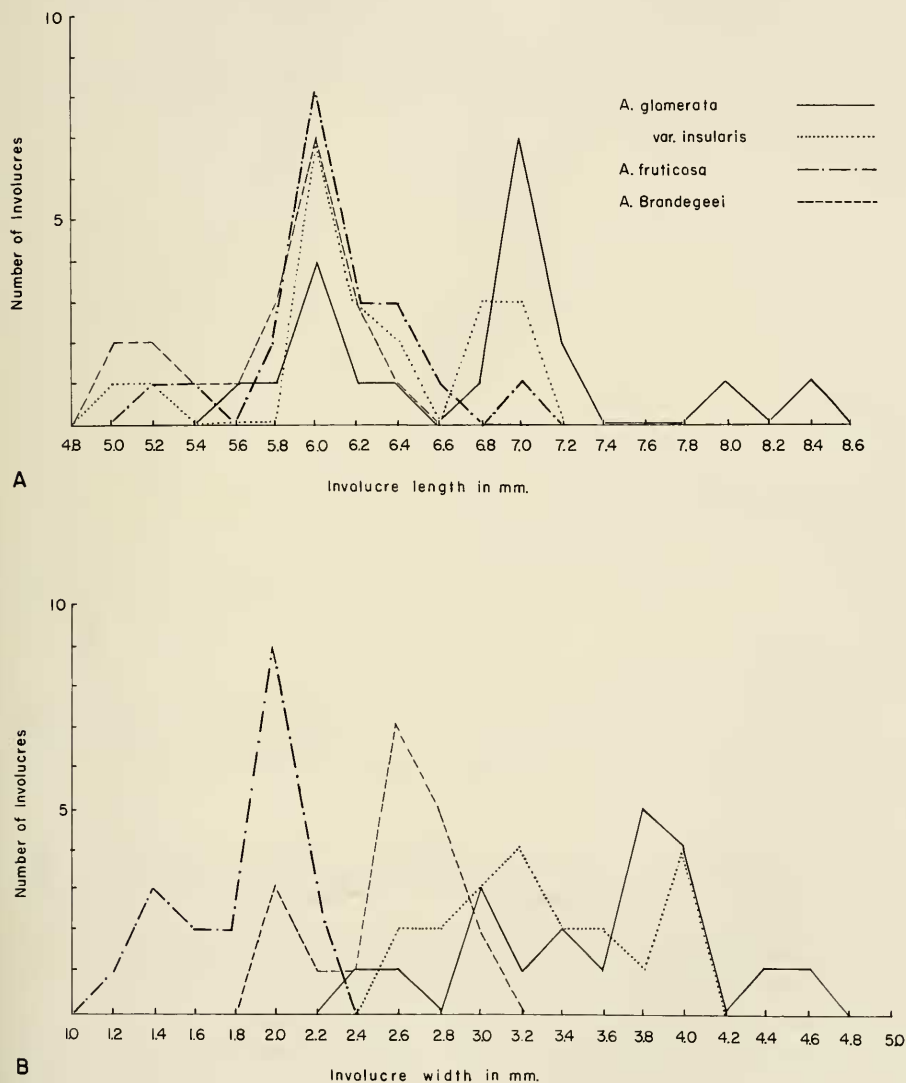


FIGURE 6. Graphs comparing involucre length and width in the taxa of *Alvordia*. See discussion in text. A, involucre length; B, involucre width.

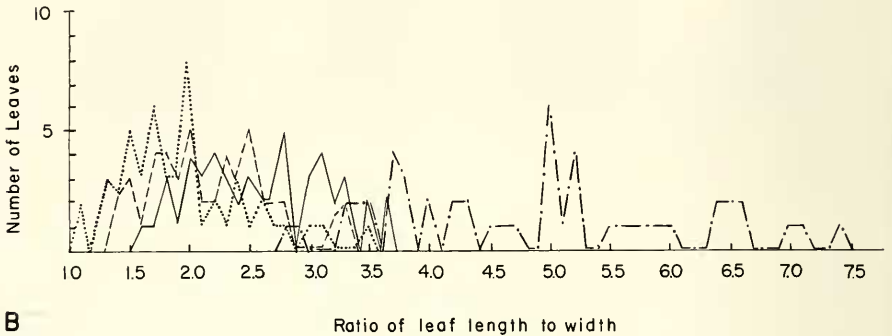
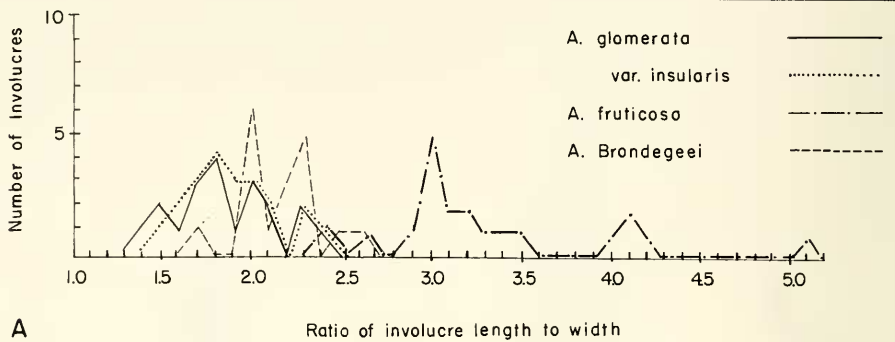


FIGURE 7. Graphs representing length to width ratio of structures in taxa of *Alvordia*. See discussion in text. A, ratio of involucre length to involucre width; B, ratio of leaf-length to leaf-width.

certain limits (figure 7B). Those of *A. glomerata* and its variety and *A. Brondegeei* occupy much the same area of the graph, but each with its separate peak, while most of those of *A. fruticoso* occupy a separate part of the graph. The graph representing length of the involucres (figure 6A) shows that a large proportion of all of the taxa in *Alvordia* have involucres within the size range of 5.8 to 6.2 mm. but that *A. glomerata* also has a high proportion of much longer involucres (6.8 to 7.2 mm. long). In the character of involucre width (figure 6B), however, as might be expected from the number of flowers per head, each of the three species shows a separate peak in the graph. When these involucre measurements are converted to length/width ratios, *A. fruticoso* stands well apart and the other three are in close approximation to each

other although each species maintains a distinct peak (figure 7A). In pollen size (figure 8), that of *A. fruticosa* and *A. Brandegeei* is found to be at the opposite extremes for members of the genus and that of *A. glomerata* is in the middle.

Chromosome counts in *Alvordia* are of interest, the two Cape Region taxa having counts of $n=15$ (*A. Brandegeei*) and $n=30$ (*A. fruticosa*). Counts of several collections of *A. glomerata* indicate that it is a polyploid with a chromosome number of $n=60$. To date, no count has been obtained for *A. glom-*

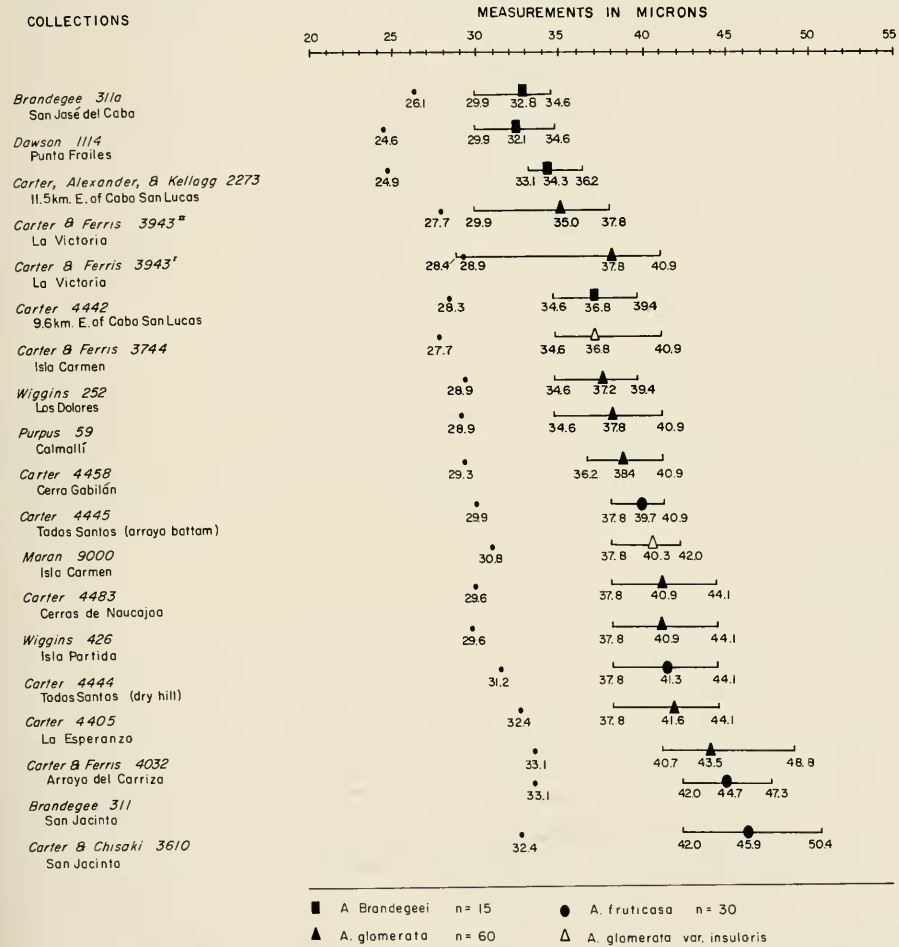


FIGURE 8. Comparative size of pollen grains in *Alvordia*. The left-hand series of figures represents the measurements excluding the spines; the right-hand series (showing minimum, mean and maximum measurements) includes the spines.

erata var. *insularis*, but on the basis of correlation of pollen size with chromosome number (figure 8), one would expect it also to have a count of $n=60$. The fact that the polyploid occupies the territory to the north of the Cape Region, correlates well with the geological history of southern Baja California. Not until the Pleistocene did the Cape Region, which had a long geologic history as an island, become permanently connected with the rest of the peninsula. To the north of the Cape Region during the Miocene, seas are thought to have covered all of western southern Baja California except for the islands in the Magdalena Bay area and the mountains in the Viscaïno Desert and Ced-

TABLE I. *Comparison of Taxa of Alvordia*

CHARACTER	<i>A. fruticosa</i>	<i>A. Brandegeei</i>	<i>A. glomerata</i>	<i>A. glomerata</i> var. <i>insularis</i>
Leaves				
shape	narrowly lanceolate to linear-lanceolate, acute	ovate to broadly lanceolate, acute	lanceolate to ovate-lanceolate, acute	oval to ovate or obovate, obtuse (sometimes cuspidate)
mean length/ width ratio	4.27/1	2.27/1	2.59/1	1.94/1
Involucres				
mean length/ width ratio	3.45/1	2.24/1	1.87/1	1.91/1
flowers per involucre	1 (-2) disk only	2 (-3) disk; occasional inconspicuous ray	1-3 ray; 2-3 disk	1-2 ray; 2-4 disk
Phyllaries & receptacular bracts				
number	4-6 (mostly 6)	5-8	7-9 (sometimes up to 12)	7-10 (mostly 8-9)
color	straw-yellow	straw-yellow	greenish- or brownish yellow	yellow-green to gray-green
pubescence	glabrous, finely ciliolate-margined	glabrous, ciliolate-margined	strigose abaxially, ciliate-margined	slightly strigillose abaxially, ciliate-margined
Achenes	pappus shorter than achene	pappus shorter than or sometimes subequal to achene	pappus equalling achene	pappus longer than (sometimes equalling) achene
Pollen diameter (inc. spines)				
extremes	37.8-50.4 microns	29.9-39.4 microns	28.4-48.8 microns	34.6-42.0 microns
mean	42.9 microns	33.7 microns	40.17 microns	38.5 microns
Chromosomes	$n = 30$	$n = 15$	$n = 60$?

ros Island; and on the eastern side of the peninsula only the mountainous area from about the latitude of Loreto to a little north of Santa Rosalía is thought to have been above water (Durham & Allison, 1960). Subsequent elevation resulted in the outlines of the peninsula becoming much as we now know them, but there was also extensive volcanic action which must have made much of this area untenable to higher plants for some time. So the polyploid *A. glomerata* undoubtedly evolved from the Cape Region form or forms then extant and worked its way northward as this new territory became available (Stebbins, 1950), becoming more and more distinct from the Cape Region plants as it advanced towards the present northern limit of its range.

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LITERATURE CITED

- BLAKE, S. F.
1917. New and noteworthy Compositae, chiefly Mexican. Contributions of the Gray Herbarium, vol. 52, pp. 16-59.
- BRANDEGEE, T. S.
1889. A collection of plants from Baja California, 1889. Proceedings of the California Academy of Sciences, ser. 2, vol. 2, pp. 117-216.
1899. New species of plants from Mexico. Erythea, vol. 7, pp. 1-9.
- CRONQUIST, A.
1955. Phylogeny and taxonomy of the Compositae. American Midland Naturalist, vol. 53, pp. 478-511.
- DURHAM, J. W., AND E. C. ALLISON
1960. Symposium: The biogeography of Baja California and adjacent seas. Part I. Geologic history. The geologic history of Baja California and its marine faunas. Systematic Zoology, vol. 9, pp. 47-91.

LANJOUW, J., AND F. A. STAFLEU

1959. *Index Herbariorum. Part I. The Herbaria of the World. Fourth Edition.*
249 pp. Utrecht, Netherlands.

LINDLEY, J.

1938. *Illustrated dictionary of botanical terms, reprinted from Lindley's Introduction to Botany, Book III.* London. Pp. 346-383. Also Book I, p. 319. Introduction by Alice Eastwood.

MORAN, R. V.

1952. *The Mexican itineraries of T. S. Brandegee. Madroño, vol. 11, pp. 253-262.*

STEBBINS, G. L., JR.

1950. *Variation and evolution in plants.* Columbia University Press, New York.
xx + 643 pp.